WE CLAIM:

1. A distributed, circular geometry, power amplifier for amplifying an RF input signal, comprising:

a plurality of push-pull amplifiers, each amplifier including two gain blocks, each having an input port with positive and negative terminals and an output port with positive and negative terminals, wherein:

(i) the two gain blocks of each push-pull amplifier are interconnected at the positive terminals of their respective output ports by an inductive path and share a common supply voltage to the positive terminals of their respective output ports;

(ii) the negative terminal of the output port of each gain block of each push-pull amplifier is connected to negative terminal of the output port of a gain block of an adjacent push-pull amplifier such that the amplifiers are configured in an interconnected circular geometry, with the connected negative terminals of adjacent gain blocks being connected together to form a virtual ac ground; and

(iii) the input port of each gain block is adapted to receive an ac input signal of at least substantially equal magnitude and opposite phase relative to the input port of an adjacent gain block.

2. A distributed, circular geometry, power amplifier, comprising:

(a) a first push-pull amplifier adapted to amplify an RF input signal, including a first gain block and a second gain block, each block having an input port with positive and negative terminals and an output port with positive and negative terminals, the blocks being interconnected at the positive terminals of their respective output ports by an inductive path; and

(b) a second push-pull amplifier including a third gain block adjacent the second gain block and a fourth gain block, the third and forth gain blocks each having an input port with positive and negative terminals and an output port with positive and negative terminals, the gain blocks of the second push-pull amplifier being interconnected at the positive terminals of their respective output ports by an inductive path,

wherein the adjacent second and third gain blocks are interconnected at the negative terminals of their respective output ports to form a virtual ac ground and the negative terminal of the output port of the fourth gain block is connected to the negative terminal of the output port of the first gain block such that substantially all ac current that flows from the fourth gain block flows into the first gain block, and

wherein the input port of each adjacent gain block is adapted to receive an input signal of at least substantially equal magnitude and opposite phase.

3. The power amplifier of claim 2, wherein the push-pull amplifiers are interconnected such that, for the fundamental frequency of operation, virtual ac-grounds are presented at the negative terminals of the output ports of the gain blocks.

4. The power amplifier of claim 2, further including at least one additional push-pull amplifier having a pair of interconnected gain blocks, such that the negative terminal of the output port of the fourth gain block is indirectly connected to the negative terminal of the output port of the first gain block via the at least one additional push-pull amplifier.

5. The power amplifier of claim 2, further including

(a) a third push-pull amplifier having fifth and sixth gain blocks, each block having an input port with positive and negative terminals and an output port with positive and negative terminals, the fifth and sixth blocks being interconnected at the positive terminals of their respective output ports by an inductive path, and

(b) a fourth push-pull amplifier having seventh and eighth gain blocks, each block having an input port with positive and negative terminals and an output port with positive and negative terminals, the seventh and eighth blocks being interconnected at the positive terminals of their respective output ports by an inductive path, wherein

the negative terminal of the output port of the fourth gain block is connected to the negative terminal of the output port of the fifth gain block,

the negative terminal of output port of the sixth gain block is connected to the negative terminal of the output port of the seventh gain block, and

the negative terminal of output port of the eighth gain block is connected to the negative terminal of the output port of the first gain block.

6. The amplifier of claim 2, wherein each gain block comprises at least a first and a last three-terminal active device each having a cathode, an anode and a control terminal, the active devices of each gain block being connected together in cascode such that the cathode of the first active device serves as the negative terminal of the output port each gain block, the anode of the last active device serves as the positive terminal of the output port of each gain block, and the control terminal of the first active device is the input port of the gain block.

7. The power amplifier of claim 2, wherein the push-pull amplifiers are monolithically integrated.

8. The power amplifier of claim 2, wherein the inductive path of each push-pull amplifier is a metal slab.

9. The power amplifier of claim 8, wherein the inductive path is a substantially straight metal slab.

10. The power amplifier of claim 2, further including a resonant, harmonic tuning capacitor that is connected between the positive terminals of the output ports of adjacent gain blocks of adjacent push-pull amplifiers.

11. The power amplifier of claim 2, further including an inductive loop disposed between the input ports of adjacent gain blocks of adjacent push-pull amplifiers in order to tune the impedance presented to the RF input signal.

12. The power amplifier of claim 2, further including an input power splitting network that symmetrically connects an in-phase balanced input signal to be amplified to the input ports of all gain blocks.

13. The power amplifier of claim 12, wherein the input power splitting network symmetrically connects the in-phase balanced input signal from a point inside the circular geometry of the power amplifier.

14. The power amplifier of claim 12, wherein the input power splitting network symmetrically connects the in-phase balanced input signal from points outside the circular geometry of the power amplifier.

15. The power amplifier of claim 2, further including a power-combining circuit connected to the push-pull amplifiers that combines the signals amplified by each of the push-pull amplifiers.

16. The power amplifier of claim 15, wherein the push-pull amplifiers are configured as a first closed loop to form a circular geometry primary winding of an active transformer, and the power-combining circuit is configured as a secondary winding of the active transformer that is located in proximity with and magnetically coupled to the primary winding, the secondary winding having an output that provides the summed outputs of the push-pull amplifiers in the closed first loop.

17. The power amplifier of claim 16, wherein the secondary winding is a single turn circuit.

18. The power amplifier of claim 16, wherein the secondary winding is a conductive body having variable width sections.

19. The power amplifier of claim 16, further including an input power splitting network that symmetrically connects an in-phase balanced input signal to be amplified from a point inside the circular geometry of the power amplifier to each input port of each gain block.

20. The power amplifier of claim 19, wherein the input power splitting network comprises a plurality of twisted input loops in proximity with the secondary

winding, thereby providing magnetic coupling from the secondary winding in order to enhance the gain or linearity of each push-pull amplifier.

21. The power amplifier of claim 16, further including at least one additional secondary winding in proximity with and magnetically coupled to the primary and secondary windings to create an interdigitated transformer.

22. The power amplifier of claim 16, further including at least one additional circular-geometry primary winding in proximity with and magnetically coupled to the primary and secondary windings to create an interdigitated transformer.

23. A distributed, circular geometry, power amplifier for amplifying an RF input signal, comprising:

a plurality of push-pull amplifiers, each amplifier including a first three-terminal active device and a second three-terminal active device, each active device having an anode, a cathode and a control electrode and adapted to amplify an input signal, wherein:

(i) the two active devices of each push-pull amplifier are interconnected at their respective anodes by an inductive path and share a common supply voltage to their respective anodes,

(ii) the cathode of one active device of each push-pull amplifier is directly connected to the cathode of an adjacent active device of an adjacent push-pull amplifier such that the amplifiers are configured in an interconnected circular geometry, with the directly-connected cathodes of adjacent active devices being connected together to form a virtual ac ground, and

(iii) the control electrode of each adjacent active device is adapted to receive an input signal of at least substantially equal magnitude and opposite phase.

24. A distributed, circular geometry, power amplifier, comprising:

(a) a first push-pull amplifier adapted to amplify an RF input signal, including

(i) a first three-terminal active device having an anode, a cathode and a control electrode,

(ii) a second three-terminal active device having an anode, a cathode and a control electrode, and

(iii) an inductive path that interconnects the anodes of the first and second active devices, the anodes sharing a common supply voltage; and

(b) a second push-pull amplifier adapted to further amplify the RF input signal, including

(i) a third three-terminal active device adjacent the second active device and having an anode, a cathode and a control electrode,

(ii) a fourth three-terminal active device having an anode, a cathode and a control electrode, and

(iii) a second inductive path that interconnects the anodes of the third and forth active devices, the anodes of the third and fourth devices sharing a common supply voltage,

wherein the first and second push-pull amplifiers are interconnected in a circular geometry such that the cathode of the second active device is connected to the cathode of the third active device to form a virtual ac ground, the cathode of the first active device is connected to the cathode of the fourth active device, such that substantially all ac current that flows from the fourth active device flows into the first active device, and

wherein the control electrode of each adjacent active device is adapted to receive an input signal of at least substantially equal magnitude and opposite phase.

25. The amplifier of claim 24, wherein the cathode of the second active device is directly connected to the cathode of the third active device and the cathode of the first active device is indirectly connected to the cathode of the fourth active device via at least one additional push-pull amplifier.

26. The power amplifier of claim 25, further including

(a) a third push-pull amplifier having fifth and sixth active devices, each device having an anode, a cathode, and a control electrode, the fifth and sixth devices being interconnected at the anodes by an inductive path, and

10051057.031601

(b) a fourth push-pull amplifier having seventh and eighth active devices, each device having an anode, a cathode, and a control electrode, the seventh and eighth devices being interconnected at the anodes by an inductive path, wherein

the cathode of the fourth active device is connected to the cathode the fifth active device,

the cathode of the sixth active device is connected to the cathode of the seventh active device, and

the cathode of the eighth active device is connected to the cathode of the first active device.

27. The power amplifier of claim 24, wherein the push-pull amplifiers are monolithically integrated.

28. The power amplifier of claim 24, wherein the inductive path of each push-pull amplifier is a metal slab.

29. The power amplifier of claim 28, wherein the inductive path is a substantially straight metal slab.

30. The power amplifier of claim 24, further including a resonant, harmonic tuning capacitor that is connected between the positive terminals of the output ports of adjacent gain blocks of adjacent push-pull amplifiers.

31. The power amplifier of claim 24, further including an inductive loop disposed between the two control electrodes of adjacent active devices of adjacent push-pull amplifiers in order to tune the impedance presented to the RF input signal.

32. The power amplifier of claim 24, further including an input power splitting network that symmetrically connects an in-phase balanced input signal to be amplified to each of the control electrodes of each active device.

33. The power amplifier of claim 32, wherein the input power splitting network symmetrically connects the in-phase balanced input signal from a point inside the circular geometry of the power amplifier.

34. The power amplifier of claim 32, wherein the input power splitting network symmetrically connects the in-phase balanced input signal from points outside the circular geometry of the power amplifier.

35. The power amplifier of claim 24, further including a power-combining circuit connected to the push-pull amplifiers that combines the signals amplified by each of the push-pull amplifiers.

36. The power amplifier of claim 35, wherein the push-pull amplifiers are configured as a first closed loop to form a circular geometry primary winding of an active transformer, and the power-combining circuit is configured as a secondary winding of the active transformer that is located in proximity with and magnetically coupled to the primary winding, the secondary winding having an output that provides the summed outputs of the push-pull amplifiers in the closed first loop.

37. The power amplifier of claim 36, wherein the secondary winding is a single turn circuit.

38. The power amplifier of claim 36, wherein the secondary winding is a conductive body having variable width sections.

39. The power amplifier of claim 36, further including an input power splitting network that symmetrically connects an in-phase balanced input signal to be amplified from a point inside the circular geometry of the power amplifier to each of the control electrodes of each active device.

40. The power amplifier of claim 39, wherein the input power splitting network comprises a plurality of twisted input loops in proximity with the secondary

winding, thereby providing magnetic coupling from secondary winding in order to enhance the gain or linearity of each push-pull amplifier.

41. The power amplifier of claim 36, further including at least one additional secondary winding in proximity with and magnetically coupled to the primary and secondary windings to create an interdigitated transformer.

42. The power amplifier of claim 36, further including at least one additional circular-geometry primary winding in proximity with and magnetically coupled to the primary and secondary windings to create an interdigitated transformer.

43. A distributed, active-transformer, power-amplifier, comprising:

(a) a first push-pull amplifier, including a first three-terminal active device and a second three-terminal active device each having a cathode, an anode and a control electrode, the active devices being interconnected at their respective anodes by a first inductive path, the anodes sharing a common supply at a point on the inductive path;

(b) a second push-pull amplifier, including a third three-terminal active device and a fourth three-terminal active device each having a cathode, an anode and a control electrode, the third and forth active devices being interconnected at their respective anodes by a second inductive path, the anodes sharing a common supply at a point on the inductive path;

(c) a third push-pull amplifier, including a fifth three-terminal active device and a sixth three-terminal active device each having a cathode, an anode and a control electrode, the fifth and sixth active devices being interconnected at their respective anodes by a third inductive path, the anodes sharing a common supply at a point on the inductive path; and

(d) a fourth push-pull amplifier, including a seventh three-terminal active device and an eighth three-terminal active device, each having a cathode, an anode and a control electrode, the seventh and eighth active devices being interconnected at their respective anodes by a fourth inductive path, the anodes sharing a common supply at a point on the inductive path;

the amplifiers being interconnected in a circular geometry such that the cathode of each active device of each amplifier is connected to the cathode of an adjacent active device of an adjacent amplifier, with both cathodes being interconnected to form a virtual ac ground, and

each active device is operable in a phase opposite to the phase of an adjacent active device of an adjacent push-pull amplifier.

44. A method of combining the amplified outputs of a plurality of push-pull amplifiers to form a power amplifier, each push-pull amplifier having two inductively-interconnected gain blocks, comprising:

(a) configuring the plurality of amplifiers to form a first closed loop such that adjacent gain blocks of adjacent amplifiers are interconnected and as so interconnected, form virtual ac grounds; and

(b) driving adjacent gain blocks of adjacent push-pull amplifiers with at least substantially equal and opposite input signals.

45. The method of claim 44, further including combining the output power of the push-pull amplifiers in the first closed loop in a secondary coil that is located in proximity with and magnetically coupled to the first closed loop.

46. A low loss inductor for deposition on a substrate of an integrated circuit that processes voltage signals, comprising:

an elongated conductive body deposed on the substrate and having

first and second ends,

conductive sections disposed between the ends, and

an average ac signal voltage across the body such that a section where the signal voltage is determined to be lower than the average ac signal voltage across the body is relatively wider than another section of the inductor where the signal voltage is determined to be higher than the average ac signal voltage across the body.

47. The inductor of claim 46, wherein the conductive body is a single turn circuit.

48. The inductor of claim 47, wherein the single turn circuit includes multiple straight interconnected metal sections.

49. The inductor of claim 46, wherein the conductive body is a multiple turn circuit.

50. The inductor of claim 46, wherein one end of the inductor is grounded such that the inductor is unbalanced.

51. The inductor of claim 46, wherein neither end of the inductor is grounded such that the inductor is balanced.

52. A method for reducing the electrical losses of an inductor deposed on a substrate of an integrated circuit, the inductor having an elongated body with interconnected conducting sections, an average width, an average ac signal voltage across the body, the method comprising:

(a) decreasing the width of a section of the body of the inductor relative to the average width whereat the ac voltage signal on the section is relatively higher than the average ac signal voltage across the inductor body; and

(b) increasing the width of another section of the body of the inductor whereat the ac voltage signal on the other section is relatively lower than the average ac signal voltage across the inductor body.

09627584.100901